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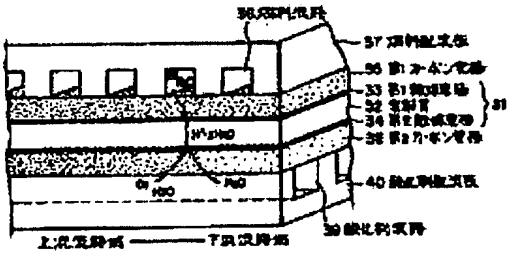
(71)Applicant : **MITSUBISHI HEAVY IND LTD**
(72)Inventor : **HASHIZAKI KATSUO**

(54) SOLID HIGH POLYMER ELECTROLYTE FUEL CELL

(57)Abstract:
PURPOSE: To enable cell reaction to be kept up stably by facilitating gas discharge while gas is being dispersed by means of steam of generated water and moving water even in the downstream of each oxidant flow path, and also facilitating discharge of generated water and moving water which are liquefied and/or formed into a state of droplets.
CONSTITUTION: The fuel cell is equipped with a laminated body 31 where an anode and a cathode are disposed on both the surfaces of an electrolyte layer 32 respectively, a fuel distributing plate 37 which is provided for the anode side of the aforesaid layer 31 while being furnished with each fuel flow path 36 feeding fuel to the aforesaid anode, and with oxidant distributing plate 40 which is provided for the cathode side of the aforesaid laminated body 31 while being furnished with each oxidant flow path 39 feeding oxidant to the aforesaid cathode. And the percentage of voids of the cathode to which oxidant is fed is made gradually large along the flow path of oxidant from the upstream side to the downstream side, so that the percentage of voids is thereby changed along an oxidant flow path 39.



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CLAIMS

[Claim(s)]
[Claim 1]A layered product which has arranged an anode pole and a cathode pole to the electrolytic both-sides side, respectively, A fuel separator with a fuel passage which is established in the anode pole side of said layered product, and supplies fuel to said anode pole, It is provided in the cathode pole side of said layered product, and an oxidizer separator with an oxidizer passage which supplies an oxidizer to said cathode pole is provided, A solid polymer electrolyte fuel cell enlarging voidage for a near cathode pole to which an oxidizer is supplied gradually along a downstream channel region from an upper channel region of an oxidizer, and changing voidage along an oxidizer passage.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the solid polymer electrolyte fuel cell which improved to the near cathode pole to which an oxidizer is supplied.
[0002]
[Description of the Prior Art]As shown in drawing 1, a solid polymer electrolyte fuel cell uses the Polymer Division ion-exchange membrane (for example, fluoro-resin ion-exchange membrane with a sulfonic group) for the electrolyte 1, and is having electrode conjugate 6 structure which equipped both sides with the catalyzer electrode layers (for example, platinum) 2 and 3 and the porous carbon electrodes 4 and 5. Hydrogen in the humidification fuel supplied to the anode pole side is hydrogen-ion-ized on the catalyzer electrode (anode pole) 2, and a hydrogen ion moves the inside of the electrolyte 1 to the cathode pole side with water as H^+andxH_2O also as the intervention of water.
[0003]The hydrogen ion which moved will react to the electron which has circulated oxygen and the external circuit 7 in an oxidizer on the catalyzer electrode (cathode terminal) 3, and will generate water, and the produced water will be discharged out of a fuel cell from the cathode pole 3. At this time, the electronic flow which circulated the external circuit 7 can be used as electrical energy of a direct current. In the Polymer Division ion-exchange membrane used as the electrolyte 1, in order to realize the above hydrogen ion permeability, It is necessary to hold this film in the water retention state which always becomes enough, and saturated steam of the operating-temperature neighborhood of a cell is usually included in fuel or an oxidizer, namely, it humidifies, and he supplies fuel and an oxidizer to the electrode conjugate 6, and is trying to maintain a membranous water retention state. Below, the reaction formula in the above-mentioned solid polymer electrolyte fuel cell is shown.
anode side: -- H_2 __ ->$2H^+$+$2e^-$ cathode side: (1/2) -- O_2+$2H^+$+$2e^-$ ->H_2O overall reaction: -- H_2+(1/2) O_2->H_2O drawing 2 shows an example of the composition of the conventional solid polymer electrolyte fuel cell.
[0004]11 in a figure is the layered product which laminated the 1st catalyzer electrode (anode pole) 13 and the 2nd catalyzer electrode (cathode pole) 14 to the upper and lower sides of the electrolyte 12. The 1st carbon electrodes (anode electrode) 15 and the fuel separator 17 with the fuel passage 16 are formed in this layered product 11 upper part. The 2nd carbon electrodes (anode electrode) 18 and the oxidizer separator 20 with the oxidizer passage 19 are formed in said layered product 11 bottom.
[0005]In such a fuel cell, the fuel hydrogen which has flowed through said fuel passage 16 passes the 1st carbon electrodes 15, and is hydrogen-ion-ized on the 1st catalyzer electrode 13, and a hydrogen ion moves the inside of the electrolyte 12 to the cathode pole side with water as basis H^+andxH_2O of an intervention of water. By this hydrogen ion, the water generated on the 2nd catalyzer electrode 14, and the water which has moved from the anode pole side with the hydrogen ion in the inside of the electrolyte 12 A steam. Or with a fluid, the 2nd carbon

electrodes 18 that have uniform voidage structure along the oxidizer passage 19 are passed, and a part is discharged by the oxidizer passage 19 through which an oxidizer flows.
[0006]
[Problem(s) to be Solved by the Invention]However, with porosity carbon electrodes with the uniform voidage, along an oxidizer passage as shown in drawing 2. Since the steam partial pressure in the oxidizer atmosphere rises so that the produced water by which it is generated in connection with a cell reaction, and the move water which moves to a cathode pole from an anode pole with a hydrogen ion go to the lower stream of the oxidizer passage 17, it will become a steam and gas diffusion discharge will become is hard to be carried out. Fluid-izing, and produced water and move water which were drop-ized were got blocked into porosity cathode pole side carbon electrodes in part, and it had become the structure where the gas diffusion of the oxidizer in porosity carbon electrodes was easy to be prevented. For this reason, the situation where a stable cell reaction was hard to be performed had happened.
[0007]This invention the porosity side carbon electrodes in which it was made in consideration of such a situation, and an oxidizer is supplied by enlarging voidage gradually along a downstream channel region from the upper channel region of an oxidizer, Change voidage along an oxidizer passage, have it, and the gas diffusion discharge by the steam of produced water or move water is easy to be performed even in the downstream area of an oxidizer passage, and fluid-izing, the drop-ized produced water, and move water also make it be easy to be discharged, It aims at providing the solid polymer electrolyte fuel cell which continues the stable cell reaction and can be made.
[0008]
[Means for Solving the Problem]A solid polymer electrolyte fuel cell this invention's possessing an oxidizer separator characterized by comprising the following, enlarging voidage for a near cathode pole to which an oxidizer is supplied gradually along a downstream channel region from an upper channel region of an oxidizer, and changing voidage along an oxidizer passage.
A layered product which has arranged an anode pole and a cathode pole to the electrolytic both-sides side, respectively.
A fuel separator with a fuel passage which is established in the anode pole side of said layered product, and supplies fuel to said anode pole.
An oxidizer passage way which is established in the cathode pole side of said layered product, and supplies an oxidizer to said cathode pole.

[0009]
[Function]By enlarging voidage for a porosity side carbon-electrodes structure where an oxidizer is supplied, gradually along a downstream channel region from the upper channel region of an oxidizer passage, and changing voidage along an oxidizer passage. Even if the steam partial pressure in oxidizer atmosphere rises in the downstream channel region of an oxidizer passage, produced water and move water serve as a steam, gas diffusion discharge is easy to be carried out, or fluid-izing, the drop-ized produced water, and move water pass carbon electrodes, and become that it is easy to be discharged all over an oxidizer passage.
[0010]
[Example]Hereafter, one working example of this invention is described with reference to drawing 3.
[0011]31 in a figure is the layered product which laminated the 1st catalyzer electrode (anode pole) 33 and the 2nd catalyzer electrode (cathode pole) 34, respectively to the upper and lower sides of the electrolyte 32 which consists of a Polymer Division ion-exchange membrane (for example, fluoro-resin ion-exchange membrane with a sulfonic group). The 1st carbon electrodes (anode electrode) 35 and the fuel separator 37 with the fuel passage 36 are formed in this layered product 31 upper part. The 2nd carbon electrodes (anode electrode) 38 and the oxidizer separator 40 with the oxidizer passage 39 are formed in said layered product 31 bottom. In such a fuel cell, the 2nd porosity side carbon electrodes 38 in which an oxidizer is supplied enlarge voidage (arrow direction) gradually along a downstream channel region from the upper channel region of an oxidizer passage, and have the structure where voidage was changed along the

oxidizer passage 39.
[0012]In the solid polymer electrolyte fuel cell of such a structure, the fuel hydrogen which has flowed through the fuel passage 36 passes the 1st carbon electrodes 36, It is hydrogen-ion-ized on the 1st catalyzer electrode 33, and a hydrogen ion moves the inside of the electrolyte 32 to the cathode pole side with water as basis H^+andxH_2O of an intervention of water. The water generated by this hydrogen ion on the 2nd catalyzer electrode 34, and the water which has moved from the anode pole side with the hydrogen ion in the inside of the electrolyte 32, Even if the steam partial pressure in oxidizer atmosphere is high, with a fluid, a steam or a part passes the 2nd carbon electrodes 38, and is discharged by the oxidizer passage 39 through which an oxidizer flows. According to above-mentioned working example, the 2nd porosity side carbon electrodes 38 in which an oxidizer is supplied enlarge voidage gradually along a downstream channel region from the upper channel region of the oxidizer passage 39, and have the structure where voidage was changed along the oxidizer passage 39. Therefore, with produced water and move water which were discharged in the upper channel region of the oxidizer passage 39, although the steam partial pressure in the oxidizer atmosphere rises in the downstream channel region of the oxidizer passage 39, From the voidage of the 2nd porosity carbon electrodes 38 being large. The gas diffusion discharge by the steam of produced water or move water is easy to be performed even in the downstream area of the oxidizer passage 39, and fluid-izing, the drop-ized produced water, and move water also pass the 2nd carbon electrodes 38, and have become that it is easy to be discharged all over the oxidizer passage 39. It enables this to perform the stable cell reaction continuously.
[0013]
[Effect of the Invention]As explained in full detail above, in this invention, voidage is gradually enlarged for the porosity side carbon electrodes in which an oxidizer is supplied along a downstream channel region from the upper channel region of an oxidizer.
Therefore, change voidage along an oxidizer passage, have it, and the gas diffusion discharge by the steam of produced water or move water is easy to be performed even in the downstream area of an oxidizer passage, and fluid-izing, the drop-ized produced water, and move water also make it be easy to be discharged, The solid polymer electrolyte fuel cell which continues the stable cell reaction and can be made can be provided.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application]This invention relates to the solid polymer electrolyte fuel cell which improved to the near cathode pole to which an oxidizer is supplied.

[Translation done.]

PRIOR ART

[Description of the Prior Art]As shown in drawing 1, a solid polymer electrolyte fuel cell uses the Polymer Division ion-exchange membrane (for example, fluoro-resin ion-exchange membrane with a sulfonic group) for the electrolyte 1, and is having electrode conjugate 6 structure which equipped both sides with the catalyzer electrode layers (for example, platinum) 2 and 3 and the porous carbon electrodes 4 and 5. Hydrogen in the humidification fuel supplied to the anode pole side is hydrogen-ion-ized on the catalyzer electrode (anode pole) 2, and a hydrogen ion moves the inside of the electrolyte 1 to the cathode pole side with water as H^+andxH_2O also as the intervention of water.

[0003]The hydrogen ion which moved will react to the electron which has circulated oxygen and the external circuit 7 in an oxidizer on the catalyzer electrode (cathode terminal) 3, and will generate water, and the produced water will be discharged out of a fuel cell from the cathode pole 3. At this time, the electronic flow which circulated the external circuit 7 can be used as electrical energy of a direct current. In the Polymer Division ion-exchange membrane used as the electrolyte 1, in order to realize the above hydrogen ion permeability, It is necessary to hold this film in the water retention state which always becomes enough, and saturated steam of the operating-temperature neighborhood of a cell is usually included in fuel or an oxidizer, namely, it humidifies, and he supplies fuel and an oxidizer to the electrode conjugate 6, and is trying to maintain a membranous water retention state. Below, the reaction formula in the above-mentioned solid polymer electrolyte fuel cell is shown.

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[0005]In such a fuel cell, the fuel hydrogen which has flowed through said fuel passage 16 passes the 1st carbon electrodes 15, and is hydrogen-ion-ized on the 1st catalyzer electrode 13, and a hydrogen ion moves the inside of the electrolyte 12 to the cathode pole side with water as basis H^+andxH_2O of an intervention of water. By this hydrogen ion, the water generated on the 2nd catalyzer electrode 14, and the water which has moved from the anode pole side with the hydrogen ion in the inside of the electrolyte 12 A steam. Or with a fluid, the 2nd carbon electrodes 18 that have uniform voidage structure along the oxidizer passage 19 are passed, and a part is discharged by the oxidizer passage 19 through which an oxidizer flows.

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EFFECT OF THE INVENTION

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Therefore, change voidage along an oxidizer passage, have it, and the gas diffusion discharge by the steam of produced water or move water is easy to be performed even in the downstream area of an oxidizer passage, and fluid-izing, the drop-ized produced water, and move water also make it be easy to be discharged, The solid polymer electrolyte fuel cell which continues the stable cell reaction and can be made can be provided.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, with porosity carbon electrodes with the uniform voidage, along an oxidizer passage as shown in drawing 2. Since the steam partial pressure in the oxidizer atmosphere rises so that the produced water by which it is generated in connection with a cell reaction, and the move water which moves to a cathode pole from an anode pole with a hydrogen ion go to the lower stream of the oxidizer passage 17, it will become a steam and gas diffusion discharge will become is hard to be carried out. Fluid-izing, and produced water and move water which were drop-ized were got blocked into porosity cathode pole side carbon electrodes in part, and it had become the structure where the gas diffusion of the oxidizer in porosity carbon electrodes was easy to be prevented. For this reason, the situation where a stable cell reaction was hard to be performed had happened.
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MEANS

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OPERATION

[Function]By enlarging voidage for a porosity side carbon-electrodes structure where an oxidizer is supplied, gradually along a downstream channel region from the upper channel region of an oxidizer passage, and changing voidage along an oxidizer passage. Even if the steam partial pressure in oxidizer atmosphere rises in the downstream channel region of an oxidizer passage, produced water and move water serve as a steam, gas diffusion discharge is easy to be carried out, or fluid-izing, the drop-ized produced water, and move water pass carbon electrodes, and become that it is easy to be discharged all over an oxidizer passage.

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EXAMPLE

[Example]Hereafter, one working example of this invention is described with reference to drawing 3.
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[0012]In the solid polymer electrolyte fuel cell of such a structure, the fuel hydrogen which has flowed through the fuel passage 36 passes the 1st carbon electrodes 36, It is hydrogen-ion-ized on the 1st catalyzer electrode 33, and a hydrogen ion moves the inside of the electrolyte 32 to the cathode pole side with water as basis H^+andxH_2O of an intervention of water. The water generated by this hydrogen ion on the 2nd catalyzer electrode 34, and the water which has moved from the anode pole side with the hydrogen ion in the inside of the electrolyte 32, Even if the steam partial pressure in oxidizer atmosphere is high, with a fluid, a steam or a part passes the 2nd carbon electrodes 38, and is discharged by the oxidizer passage 39 through which an oxidizer flows. According to above-mentioned working example, the 2nd porosity side carbon electrodes 38 in which an oxidizer is supplied enlarge voidage gradually along a downstream channel region from the upper channel region of the oxidizer passage 39, and have the structure where voidage was changed along the oxidizer passage 39. Therefore, with produced water and move water which were discharged in the upper channel region of the oxidizer passage 39, although the steam partial pressure in the oxidizer atmosphere rises in the downstream channel region of the oxidizer passage 39, From the voidage of the 2nd porosity carbon electrodes 38 being large. The gas diffusion discharge by the steam of produced water or move water is easy to be performed even in the downstream area of the oxidizer passage 39, and fluid-izing, the drop-ized produced water, and move water also pass the 2nd carbon electrodes 38, and have become that it is easy to be discharged all over the oxidizer passage 39. It enables this to perform the stable cell reaction continuously.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The figure for explaining the function of a solid polymer electrolyte fuel cell.
[Drawing 2]The explanatory view of the conventional solid polymer electrolyte fuel cell.
[Drawing 3]The explanatory view of the solid polymer electrolyte fuel cell concerning one working example of this invention.
[Description of Notations]
31 [-- The 2nd catalyzer electrode and 35 / — The 1st carbon electrodes and 36 / -- A fuel passage, 37 / — A fuel separator and 38 / — The 2nd carbon electrodes and 39 / — An oxidizer passage, 40 / -- Oxidizer separator.] -- A layered product and 32 — An electrolyte and 33 — The 1st catalyzer electrode, 34

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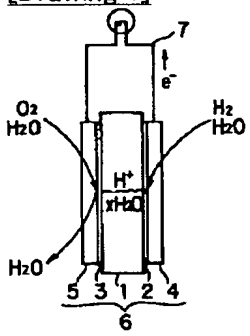
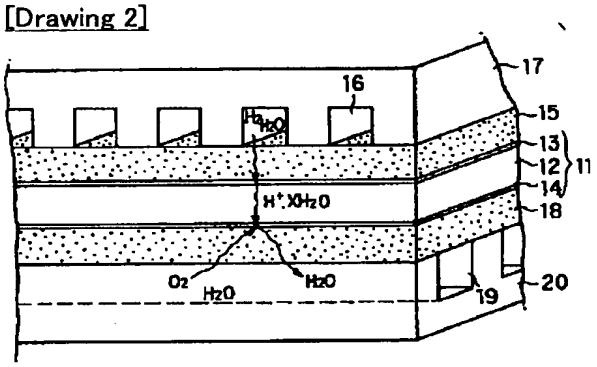
DRAWINGS

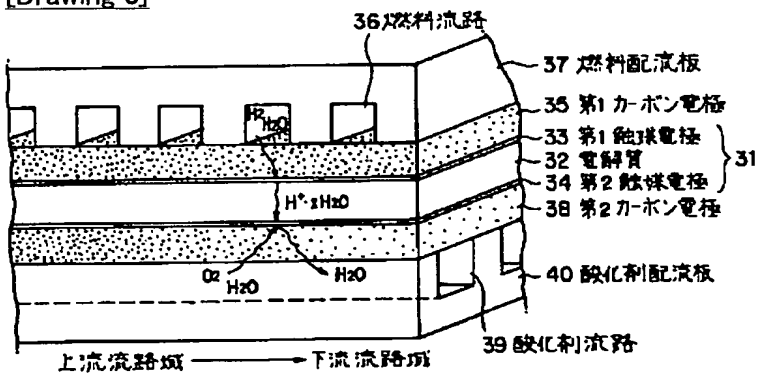
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平6－267562

(43)公開日　平成6年(1994)9月22日

(51)Int.Cl.[5]		識別記号	庁内整理番号	Ｆ Ｉ	技術表示箇所
Ｈ０１Ｍ	8/02	Ｒ	8821－4Ｋ		
	8/10		8821－4Ｋ		

審査請求　未請求　請求項の数１　ＯＬ　（全　４　頁）

(21)出願番号　特願平5－53321

(22)出願日　平成5年(1993)3月15日

(71)出願人　000006208
三菱重工業株式会社
東京都千代田区丸の内二丁目5番1号

(72)発明者　橋崎　克雄
東京都千代田区丸の内二丁目5番1号　三菱重工業株式会社内

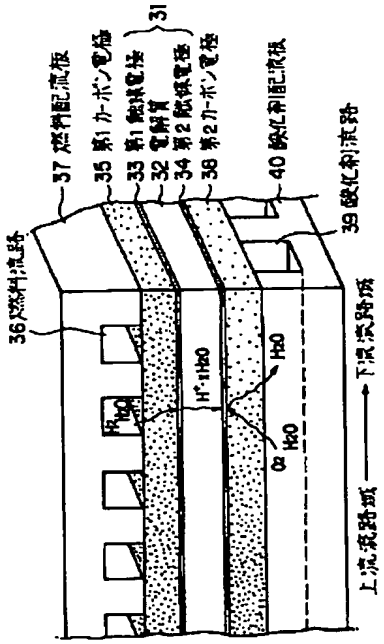
(74)代理人　弁理士　鈴江　武彦

(54)【発明の名称】　固体高分子電解質燃料電池

(57)【要約】

【目的】この発明は、酸化剤流路の下流域でも生成水や移動水の蒸気によるガス拡散排出が行われ易く、また液体化や液滴化した生成水や移動水も排出され易くして、安定した電池反応を継続してなしえることを主要な目的とする。

【構成】電解質(32)の両面側にアノード極、カソード極を夫々配置した積層体(31)と、前記積層体(31)のアノード極側に設けられ、前記アノード極に燃料を供給する燃料流路(36)を有した燃料配流板(37)と、前記積層体(31)のカソード極側に設けられ、前記カソード極に酸化剤を供給する酸化剤流路(39)を有した酸化剤配流板(40)とを具備し、酸化剤が供給される側のカソード極を、酸化剤の上流流路域から下流流路域に沿って空隙率を徐々に大きくし、空隙率を酸化剤流路(39)に沿って変化させることを特徴とする固体高分子電解質燃料電池。



【特許請求の範囲】
【請求項１】　電解質の両面側にアノード極、カソード極を夫々配置した積層体と、前記積層体のアノード極側に設けられ、前記アノード極に燃料を供給する燃料流路を有した燃料配流板と、前記積層体のカソード極側に設けられ、前記カソード極に酸化剤を供給する酸化剤流路を有した酸化剤配流板とを具備し、酸化剤が供給される側のカソード極を、酸化剤の上流流路域から下流流路域に沿って空隙率を徐々に大きくし、空隙率を酸化剤流路に沿って変化させることを特徴とする固体高分子電解質燃料電池。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明は、酸化剤が供給される側のカソード極に改良を施した固体高分子電解質燃料電池に関する。
【０００２】
【従来の技術】固体高分子電解質燃料電池は、図１に示すように、電解質１に高分子イオン交換膜（例えば、スルホン酸基を持つフッ素樹脂イオン交換膜）を用い、両側に触媒電極層（例えば白金）２，３及び多孔質カーボン電極４，５を備えた電極接合体６構造をしている。アノード極側に供給された加湿燃料中の水素は、触媒電極（アノード極）２上で水素イオン化され、水素イオンは電解質１中を水の介在もと$H^+ \cdot xH_2O$として、カソード極側へ水と共に移動する。
【０００３】移動した水素イオンは、触媒電極（カソード電極）３上で酸化剤中の酸素及び外部回路７を流通してきた電子と反応して水を生成し、その生成水はカソード極３より燃料電池外へ排出されることになる。この時、外部回路７を流通した電子流れを直流の電気エネルギーとして利用できる。なお、電解質１となる高分子イオン交換膜において、前述のような水素イオン透過性を実現させるためには、この膜を常に充分なる保水状態に保持しておく必要があり、通常、燃料又は酸化剤に電池の運転温度近辺相当の飽和水蒸気を含ませて、すなわち加湿して燃料及び酸化剤を電極接合体６に供給し、膜の保水状態を保つようにしている。以下に、上記固体高分子電解質燃料電池における反応式を示す。
アノード側：$H_2 \rightarrow 2H^+ + 2e^-$
カソード側：$(1/2)O_2 + 2H^+ + 2e^- \rightarrow H_2O$
全反応：$H_2 + (1/2)O_2 \rightarrow H_2O$
図２は、従来の固体高分子電解質燃料電池の構成の一例を示す。
【０００４】図中の11は、電解質12の上下に第１触媒電極（アノード極）13，第２触媒電極（カソード極）14を積層した積層体である。この積層体11の上側には、第１カーボン電極（アノード電極）15，燃料流路16を有した燃料配流板17が設けられている。前記積層体11の下側には、第２カーボン電極（アノード電極）18，酸化剤流路19を有した酸化剤配流板20が設けられている。
【０００５】こうした燃料電池において、前記燃料流路16を流れてきた燃料水素は、第１カーボン電極15を通過し、第１触媒電極13上で水素イオン化され、水素イオンは電解質12中を水の介在のもと$H^+ \cdot xH_2O$として、カソード極側へ水と共に移動する。この水素イオンにより、第２触媒電極14上で生成された水と、水素イオンと共にアノード極側より電解質12中を移動してきた水は、蒸気あるいは、一部液体のまま、酸化剤流路19に沿って均一な空隙率構造をした第２カーボン電極18を通過し、酸化剤が流れる酸化剤流路19に排出されるようになっている。
【０００６】
【発明が解決しようとする課題】しかしながら、図２に示すような酸化剤流路に沿ってその空隙率が均一な多孔質なカーボン電極では、電池反応に伴って発生する生成水、及び水素イオンと共にアノード極よりカソード極へ移動する移動水が、酸化剤流路17の下流へ向かうほど、その酸化剤雰囲気中の水蒸気分圧が上昇するため、蒸気となってガス拡散排出されにくくなることになる。また、一部液体化、液滴化した生成水や移動水が、カソード極側の多孔質なカーボン電極中に詰まり、多孔質なカーボン電極中の酸化剤のガス拡散が阻止され易い構造となっていた。このため、安定な電池反応が行われにくい状況が起こっていた。
【０００７】この発明はこうした事情に考慮してなされたもので、酸化剤が供給される側の多孔質なカーボン電極を、酸化剤の上流流路域から下流流路域に沿って空隙率を徐々に大きくすることにより、空隙率を酸化剤流路に沿って変化させ、もって酸化剤流路の下流域でも生成水や移動水の蒸気によるガス拡散排出が行われ易く、また液体化や液滴化した生成水や移動水も排出され易くして、安定した電池反応を継続してなしえる固体高分子電解質燃料電池を提供することを目的とする。
【０００８】
【課題を解決するための手段】この発明は、電解質の両面側にアノード極、カソード極を夫々配置した積層体と、前記積層体のアノード極側に設けられ、前記アノード極に燃料を供給する燃料流路を有した燃料配流板と、前記積層体のカソード極側に設けられ、前記カソード極に酸化剤を供給する酸化剤流路路を有した酸化剤配流板とを具備し、酸化剤が供給される側のカソード極を、酸化剤の上流流路域から下流流路域に沿って空隙率を徐々に大きくし、空隙率を酸化剤流路に沿って変化させることを特徴とする固体高分子電解質燃料電池である。
【０００９】
【作用】酸化剤が供給される側の多孔質なカーボン電極構造を、酸化剤流路の上流流路域から下流流路域に沿って空隙率を徐々に大きくして、空隙率を酸化剤流路に沿って変化させることで、酸化剤流路の下流流路域におい

て酸化剤雰囲気中の水蒸気分圧が上昇しても、生成水や移動水が蒸気となってガス拡散排出されやすく、あるいは、液体化や液滴化した生成水や移動水がカーボン電極を通過して酸化剤流路中に排出されやすくなる。

【００１０】

【実施例】以下、この発明の一実施例を図３を参照して説明する。

【００１１】図中の31は、高分子イオン交換膜（例えば、スルホン酸基を持つフッ素樹脂イオン交換膜）からなる電解質32の上下に第１触媒電極（アノード極）33，第２触媒電極（カソード極）34を夫々積層した積層体である。この積層体31の上側には、第１カーボン電極（アノード電極）35，及び燃料流路36を有した燃料配流板37が設けられている。前記積層体31の下側には、第２カーボン電極（アノード電極）38，及び酸化剤流路39を有した酸化剤配流板40が設けられている。こうした燃料電池において、酸化剤が供給される側の多孔質な第２カーボン電極38は、酸化剤流路の上流流路域から下流流路域に沿って（矢印方向）空隙率を徐々に大きくして、空隙率を酸化剤流路39に沿って変化させた構造となっている。

【００１２】こうした構造の固体高分子電解質燃料電池において、燃料流路36を流れてきた燃料水素は第１カーボン電極36を通過し、第１触媒電極33上で水素イオン化され、水素イオンは電解質32中を水の介在のもと$H^+ \cdot xH_2O$として、カソード極側へ水と共に移動する。この水素イオンにより第２触媒電極34上で生成された水と、水素イオンと共にアノード極側より電解質32中を移動してきた水は、酸化剤雰囲気中の水蒸気分圧が高くても、蒸気あるいは、一部は液体のまま、第２カーボン電極38を通過し、酸化剤が流れる酸化剤流路39に排出されるようになっている。　上記実施例によれば、酸化剤が供給される側の多孔質な第２カーボン電極38は、酸化剤流路39の上流流路域から下流流路域に沿って空隙率を徐々に大きくして、空隙率を酸化剤流路39に沿って変化させた構造となっている。従って、酸化剤流路39の上流流路域で排出された生成水や移動水により、酸化剤流路39の下流流路域では、その酸化剤雰囲気中の水蒸気分圧が上昇するが、多孔質な第２カーボン電極38の空隙率が大きくなっていることから、酸化剤流路39の下流域でも生成水や移動水の蒸気によるガス拡散排出が行われやすく、また、液体化や液滴化した生成水や移動水も、第２カーボン電極38を通過して酸化剤流路39中に排出されやすくなっている。これにより、安定した電池反応を継続して行なうことが可能となる。

【００１３】

【発明の効果】以上詳述した如くこの発明によれば、酸化剤が供給される側の多孔質なカーボン電極を、酸化剤の上流流路域から下流流路域に沿って空隙率を徐々に大きくすることにより、空隙率を酸化剤流路に沿って変化させ、もって酸化剤流路の下流域でも生成水や移動水の蒸気によるガス拡散排出が行われ易く、また液体化や液滴化した生成水や移動水も排出され易くして、安定した電池反応を継続してなしえる固体高分子電解質燃料電池を提供できる。

【図面の簡単な説明】

【図１】固体高分子電解質燃料電池の機能を説明するための図。

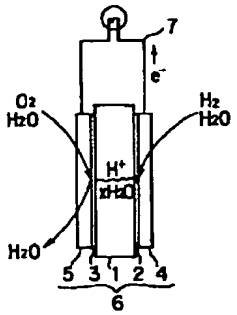
【図２】従来の固体高分子電解質燃料電池の説明図。

【図３】この発明の一実施例に係る固体高分子電解質燃料電池の説明図。

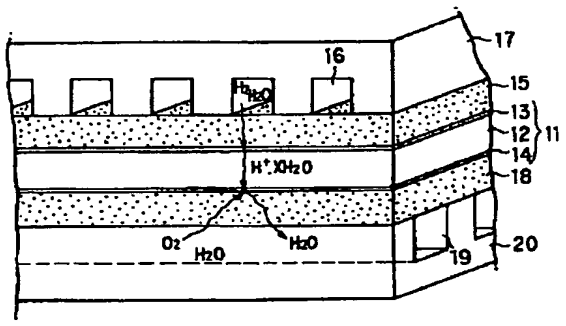
【符号の説明】

31…積層体、　32…電解質、　33…第１触媒電極、34…第２触媒電極、　35…第１カーボン電極、　36…燃料流路、37…燃料配流板、　38…第２カーボン電極、　39…酸化剤流路、40…酸化剤配流板。

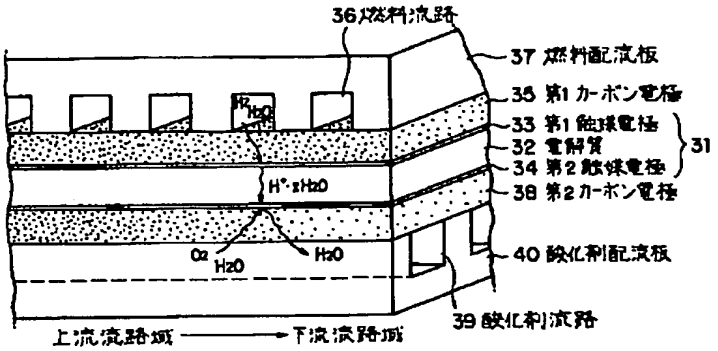
【図１】



【図２】



【図3】


36燃料流路
37 燃料配流板
35 第1 カーボン電極
33 第1 触媒電極
32 電解質
34 第2 触媒電極
31
38 第2 カーボン電極
40 酸化剤配流板
39 酸化剤流路
H2
H2O
H+·xH2O
O2
H2O
H2O
上流流路域
下流流路域